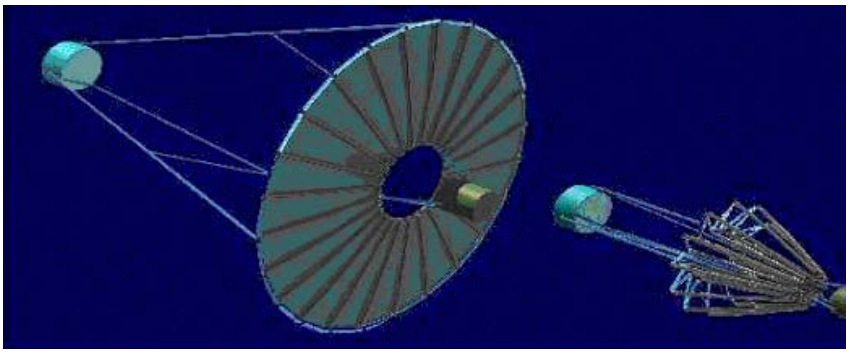
The official voice of the Air Force Research Laboratory
news@afrl
Features
August 2003

AFRL scientists achieve mirror technology milestone

by J. Rich Garcia, Directed Energy Directorate

KIRTLAND AIR FORCE BASE, N.M. — A milestone in telescope mirror technology, completed recently by Air Force scientists, is leading to large, lightweight, space-based telescopes many times larger than NASA's Hubble Space Telescope.

Rather than use a heavy, glass mirror, researchers at the Air Force Research Laboratory's Directed Energy Directorate were able to produce a 1-meter-diameter (approximately 3 ¼ feet) mirror made of a thin-film membrane material. This optical-quality polyimide mirror was more than three times larger than the biggest membrane mirror previously possible.



An artist concept shows a thin-film membrane mirror, at right, in a folded configuration so it can fit aboard a rocket and then opened in space as shown at left. Researchers at the Air Force Research Laboratory's Directed Energy Directorate reached a milestone recently by producing a 1-meter-diameter (approximately 3 ¼ feet), optical-quality membrane mirror. Their goal is to produce a lightweight 10-meter membrane mirror, which could be used as part of a space-based telescope.

In this case, the membrane material was also of exceptional optical quality as judged by the uniformity of its thickness, which didn't vary by more than an average of 25 nanometers or approximately one-millionths of an inch.

Shifting from glass mirrors was necessary because of the limited cargo capacity of the space shuttle and other rocket boosters. But replacing glass with thin-film meant that a mirror could be transported to space in a folded or rolled configuration aboard a current rocket and then unrolled or expanded like an umbrella once in space.

According to 2nd Lt. Ethan D. Holt, the film mirror project officer in the directorate's Surveillance Technologies Branch, "Our goal is to produce a telescope mirror with a diameter of 10 meters or nearly. A surveillance telescope that size in orbit 124 miles over the earth would really improve our ability to image enemy and friendly assets and capabilities."

"The larger the mirror, the greater its ability to see, or resolve, objects on the ground," explained Dr. Richard A. Carreras, the branch's technical advisor. "For example, a 10-meter telescope in Los Angeles would be able to tell the difference between a basketball and a volleyball as far away as Washington D.C."

Large space-based telescopes could also be used to focus the energy from lasers, another potential application for this technology.

Laboratory researchers were quick to point out that their accomplishment was made possible through the Small Business Innovation Research Program, through which they were able to work with SRS Technologies of Huntsville, Ala.

"SRS Technologies provided a unique processing capability," noted Dan K. Marker, membrane mirror principle investigator. "Our collaboration led to them producing this thin-film product that was subsequently named CP1-DE. The 'DE' suffix was added to recognize the Directed Energy Directorate's role in its development." According to Marker, numerous commercial contractors including Boeing Rocketdyne Technical Service (an in-house contractor) were involved in the project. @